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(54) PTC COMPOSITION

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a PTC composition which is kept stable in characteristics even if it is repeatedly used and excellent in reproducibility, by a method wherein specific weights of a metallic conductive filler, a crosslinking agent, and a specific fullerene are compounded with a crystalline polymer.
SOLUTION: 100 pts.wt. of a high-density polyethylene resin, 300 to 550 pts.wt. of a metallic conductive filler, and 0.01 to 100 pts.wt. of a crosslinking agent are mixed together and uniformly dispersed, and thereafter 0.01 to 100 pts.wt. of a fullerene is added to the above mixture and kneaded into a conductive composition (positive temperature coefficient(PTC) composition). Then, the conductive composition is sandwiched in between the roughened surfaces of two nickel foils, which is pressed, rolled, thermally cured, and cut into unit annular PTC resistor elements. At this point, the metallic conductive filler is previously subjected to a surface treatment by the use of titanate compound coupling agent. An high molecular alloy where one or more kinds of thermoplastic high molecules are blended together is used as crystalline high molecules.

LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] The PTC constituent characterized by coming to blend the metal system conductivity filler 300 - the 550 weight sections, a cross linking agent 0.01 - the 100 weight sections, and fullerene (C60) 0.01 - the 100 weight sections to the crystalline polymer 100 weight section.
[Claim 2] The PTC constituent characterized by coming to blend the metal system conductivity filler 300 - the 550 weight sections, a cross linking agent 0.01 - the 100 weight sections, and carbon black 0.01 - the 100 weight sections to the crystalline polymer 100 weight section.
[Claim 3] The PTC constituent according to claim 1 or 2 characterized by carrying out surface treatment of said metal system conductivity filler by the titanate compound coupling agent.
[Claim 4] The PTC constituent according to claim 1 to 3 characterized by being the giant-molecule alloy with which said crystalline polymer blended one kind of thermoplastic giant molecule, or two or more kinds of giant molecules.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a cell and the PTC constituent used for the overcurrent protection component which prevents the overcurrent which flows at the time of the abnormal occurrence of electronic equipment in detail about the conductive constituent (henceforth a PTC constituent) which has PTC (Positive Temperature Coefficient; forward temperature coefficient).
[0002]
[Description of the Prior Art] Conventionally, the portable telephone which used the rechargeable battery is begun and the organic conductivity constituent which made the crystalline polymer matrix distribute the inorganic conductivity constituent of BaTiO3 grade and a carbon system conductivity filler metallurgy group system conductivity filler is known as an overcurrent protection component used for an electrical machinery and apparatus and electronic equipment.
[0003] However, although the decline in the resistivity after component actuation according [an inorganic conductivity constituent] to the repeat of a room temperature-elevated temperature is not seen, since the resistivity in a steady state is as high as 100 ohm-cm extent, it cannot pass about several A comparatively big current. This means that an inorganic conductivity constituent cannot be used as an overcurrent protection component which prevents the overcurrent which flows at the time of abnormal occurrences, such as electronic equipment.
[0004] On the other hand, an organic conductivity constituent shows low resistivity according to the electric conduction device which an electron moves through a conductive filler in order for a conductive filler to exist only in the amorphous field of a crystalline polymer matrix and to take chain-like structure, while being in temperature lower than the crystalline melting point of a crystalline polymer matrix. If temperature rises and a crystalline polymer matrix begins to dissolve, since the volume of a crystalline polymer matrix will increase, the distance between the conductive fillers in a crystalline polymer matrix progresses [destruction of breadth, consequently an electric conduction path], and resistance goes up.
[0005] The above principle of operation is applied, and it is low resistance at a room temperature, and rapidly, the PTC property that resistance becomes large is used and it is used for the overcurrent protection component at the component which resistance increases and restricts a current with a temperature rise, especially desired switching temperature (temperature to which resistance goes up rapidly).
[0006]
[Problem(s) to be Solved by the Invention] However, while performing repeat switching operation, the problem that resistivity becomes large is. That is, in order for the PTC constituent using a metal system conductivity filler to obtain the component which has good conductivity, high restoration-ization of a metal system conductivity filler must be performed, but when high restoration-ization is performed, the stability of the physical properties of the crystalline polymer which is a matrix becomes low, while performing repeat switching operation, resistivity becomes large, and there is a problem that the dependability over a repeat activity is lost.
[0007] Then, the object of this invention is to offer the PTC constituent which has the PTC effectiveness with good repeatability stably to a repeat activity.
[0008]
[Means for Solving the Problem] According to this invention, it is a crystalline polymer and a conductive

constituent containing a metal system conductivity filler, and the resistivity in 20 degrees C is 1 or less ohm-cm, and the PTC constituent in which the resistivity of 105 or more ohm-cm is shown above switching temperature is obtained. Moreover, while attaining distributed condition-ization uniform enough by performing surface treatment to a metal system conductivity filler by the titanate compound coupling agent, a PTC constituent with it is obtained. [the remarkable resistivity after a trip cycle trial and] [stable]

[0009] That is, this invention is a PTC constituent characterized by coming to blend the metal system conductivity filler 300 - the 550 weight sections, a cross linking agent 0.01 - the 100 weight sections, and fullerene (C60) 0.01 - the 100 weight sections to the crystalline polymer 100 weight section.

[0010] Moreover, this invention is a PTC constituent characterized by coming to blend the metal system conductivity filler 300 - the 550 weight sections, a cross linking agent 0.01 - the 100 weight sections, and carbon black 0.01 - the 100 weight sections to the crystalline polymer 100 weight section.

[0011] Moreover, this invention is the above-mentioned PTC constituent characterized by carrying out surface treatment of said metal system conductivity filler by the titanate compound coupling agent.

[0012] Moreover, this invention is the above-mentioned PTC constituent characterized by being the giant-molecule alloy with which said crystalline polymer blended one kind of thermoplastic giant molecule, or two or more kinds of giant molecules.

[0013] It is thought that the following phenomena compound and it demonstrates effectiveness although the reason which the resistivity after a trip cycle trial is stabilized as mentioned above with the PTC constituent of this invention, and stopped being able to increase easily is not solved enough.

[0014] That is, the PTC constituent using the conventional metal system conductivity filler is a constituent which carried out 200-350 weight section addition of the metal system conductivity filler to the crystalline polymer 100 weight section, and the metal system conductivity filler serves as an addition of extent which arrives at a marginal high electric conduction field to a crystalline polymer.

[0015] This is coming from conductivity not going up remarkably, even if it adds more than it and a conductive filler, after arriving at a marginal high electric conduction field. In the addition of extent which the physical properties of a crystalline polymer will become easy to deteriorate, and will arrive at a marginal high electric conduction field if it is made to energize repeatedly by repeat trip trial etc., if it is made to energize repeatedly by repeat trip trial etc., the effect to which the physical properties of a crystalline polymer deteriorated will be reflected greatly, and conductivity will deteriorate remarkably.

[0016] On the other hand, by making a metal system conductivity filler into a quite high addition to the crystalline polymer 100 weight section also in the 300 - 550 weight section and a marginal high electric conduction field, the PTC constituent of this invention is making small repeatedly physical-properties degradation of the crystalline polymer by energization relatively by repeat trip trial etc., and adding fullerene or carbon black 0.01 - the 100 weight sections, and makes physical-properties degradation of a crystalline polymer small as much as possible.

[0017] Physical-properties degradation of the crystalline polymer by the passage of time is controlled by adding fullerene (C60) or carbon black at the same time the phenomenon in which resistance goes up by the heat history when resistivity was stable is reduced.

[0018] Although it is not clear for details about the reason physical-properties degradation of a crystalline polymer is controlled, by adding fullerene or carbon black, the radical generated in a giant molecule is caught and it thinks because the crosslinking reaction, decomposition, or cutting of a giant molecule takes place and it is that it is ********.

[0019]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained concretely.

[0020] (Gestalt 1 of operation) The high-density-polyethylene resin 100 weight section (trade name; HY540), the TiC filler 525 weight section (product made from a Japanese virgin metal group), and the cross linking agent 5 weight section (trade name; par hexyne 25B) are added, homogeneity was distributed, after that, fullerene (C60) was further kneaded at 10 weight ****** and 150 degrees C for 15 minutes, and the conductive constituent of this invention was manufactured.

[0021] Subsequently, said conductive constituent was inserted between the split faces with a thickness of 25 micrometers which carried out split-face processing of one side of two nickel foils, and heat curing was carried out at 200 degrees C after application of pressure and spread for 15 minutes so that it might become 300

micrometers in thickness.
[0022] The PTC resistance element cut down said conductive constituent joined to the nickel foil with an outer-diameter [of 10mm] phi:bore [phi] of 6mm in the shape of a ring, and produced it.
[0023] The resistance change at the time of repeat current cutoff of this PTC resistance element was measured. It was checked that the resistance when cooling naturally and falling to a room temperature even when 5A.30V were energized by this invention as a result (drawing 1), it switches in 4 seconds and repeat current cutoff is performed 10 times can perform less than 1.5 times and repeat current cutoff conventionally more stable than the elegance (1.8 times) of initial resistance.
[0024] moreover, the resistance when cooling naturally and falling to a room temperature, when current cutoff is repeatedly neglect-among atmospheric air performed to the PTC resistance element after progress 10 times on the 100th (drawing 2), as a result of observing aging of a component -- this invention -- setting -- less than 1.5 times and the former of initial resistance -- elegance (2.5 times) -- passing -- the time -- the back -- it was checked that the stability of repeat current cutoff is high.
[0025] (Gestalt 2 of operation) The high-density-polyethylene resin 100 weight section (trade name; HY540), the TiC filler 525 weight section (product made from a Japanese virgin metal group), and the cross linking agent 5 weight section (trade name; par hexyne 25B) are added, homogeneity was distributed, after that, carbon black was further kneaded at 15 weight ****** and 150 degrees C for 15 minutes, and the conductive constituent of this invention was manufactured.
[0026] Subsequently, said conductive constituent was inserted between the split faces with a thickness of 25 micrometers which carried out split-face processing of one side of two nickel foils, and heat curing was carried out at 200 degrees C after application of pressure and spread for 15 minutes so that it might become 300 micrometers in thickness.
[0027] The PTC resistance element cut down said conductive constituent joined to the nickel foil with an outer-diameter [of 10mm] phi:bore [phi] of 6mm in the shape of a ring, and produced it.
[0028] The resistance change at the time of repeat current cutoff of this PTC resistance element was measured. It was checked that the resistance when cooling naturally and falling to a room temperature even when 5A.30V were energized by this invention as a result (drawing 3), it switches in 4 seconds and repeat current cutoff is performed 10 times can perform less than 1.5 times and repeat current cutoff conventionally more stable than the elegance (1.8 times) of initial resistance.
[0029] moreover, the resistance when cooling naturally and falling to a room temperature, when current cutoff is repeatedly neglect-among atmospheric air performed to the PTC resistance element after progress 10 times on the 100th (drawing 4), as a result of observing aging of a component -- this invention -- setting -- less than 1.7 times and the former of initial resistance -- elegance (2.5 times) -- passing -- the time -- the back -- it was checked that the stability of repeat current cutoff is high.
[0030] The high-density-polyethylene resin 100 weight section (Gestalt 3 of operation) (trade name; The TiC filler 525 weight section (product made from a Japanese virgin metal group) and the cross linking agent 5 weight section (trade name; par hexyne 25B) which performed coupling processing by HY540) and the titanate system cup phosphorus agent (trade name; KR-TTS) are added. Homogeneity was distributed, after that, carbon black was further kneaded at 15 weight ****** and 150 degrees C for 15 minutes, and the conductive constituent of this invention was manufactured.
[0031] Subsequently, said conductive constituent was inserted between the split faces with a thickness of 25 micrometers which carried out split-face processing of one side of two nickel foils, and heat curing was carried out at 200 degrees C after application of pressure and spread for 15 minutes so that it might become 300 micrometers in thickness.
[0032] The PTC resistance element cut down said conductive constituent joined to the nickel foil with an outer-diameter [of 10mm] phi:bore [phi] of 6mm in the shape of a ring, and produced it.
[0033] The resistance change at the time of repeat current cutoff of this PTC resistance element was measured. It was checked that the resistance when cooling naturally and falling to a room temperature even when 5A.30V were energized by this invention as a result (drawing 5), it switches in 4 seconds and repeat current cutoff is performed 10 times can perform repeat current cutoff more stable than the PTC resistance element (1.5 times) produced using the TiC powder which has not carried out elegance (1.8 times) and coupling processing less than 1.4 times and conventionally [of initial resistance].

[0034] moreover, the resistance when cooling naturally and falling to a room temperature, when current cutoff is repeatedly neglect-among atmospheric air performed to the PTC resistance element after progress 10 times on the 100th (drawing 6), as a result of observing aging of a component -- this invention -- setting -- less than 1.5 times and the former of initial resistance -- elegance (2.5 times) -- passing -- the time -- the back -- it was checked that the stability of repeat current cutoff is high.
[0035] (Gestalt 4 of operation) The high-density-polyethylene resin 60 weight section (trade name; HY540), the polypropylene resin 40 weight section, the TiC filler 525 weight section (product made from a Japanese virgin metal group), and the cross linking agent 5 weight section (trade name; par hexyne 25B) are added, homogeneity was distributed, after that, carbon black was further kneaded at 15 weight ****** and 150 degrees C for 15 minutes, and the conductive constituent of this invention was manufactured.
[0036] Subsequently, said conductive constituent was inserted between the split faces with a thickness of 25 micrometers which carried out split-face processing of one side of two nickel foils, and heat curing was carried out at 200 degrees C after application of pressure and spread for 15 minutes so that it might become 300 micrometers in thickness.
[0037] The PTC resistance element cut down said conductive constituent joined to the nickel foil with an outer-diameter [of 10mm] phi:bore [phi] of 6mm in the shape of a ring, and produced it.
[0038] The resistance change at the time of repeat current cutoff of this PTC resistance element was measured. As a result (drawing 7), by this invention, the resistivity in a room temperature was able to be set to 0.6-ohmcm, and resistance was able to be reduced 20% rather than the PTC resistance element (resistivity; 0.8-ohmcm) which has not carried out the polymer blend. It was checked that the resistance when cooling naturally and falling to a room temperature even when 5A.30V were energized, it switches in 4 seconds and repeat current cutoff is performed 10 times can perform repeat current cutoff more stable than the PTC resistance element (1.5 times) which has not carried out elegance (1.8 times) and a polymer blend less than 1.3 times and conventionally [of initial resistance].
[0039] moreover, the resistance when cooling naturally and falling to a room temperature, when current cutoff is repeatedly neglect-among atmospheric air performed to the PTC resistance element after progress 10 times on the 100th (drawing 8), as a result of observing aging of a component -- this invention -- setting -- less than 1.4 times and the former of initial resistance -- elegance (2.5 times) -- passing -- the time -- the back -- it was checked that the stability of repeat current cutoff is high.
[0040]
[Effect of the Invention] As mentioned above, as explained, according to this invention, the PTC constituent which has the PTC effectiveness with good repeatability stably to a repeat activity can be offered.

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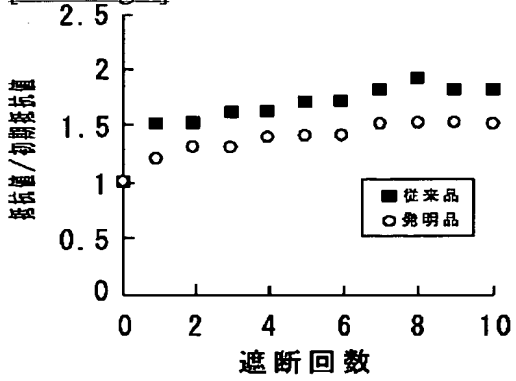
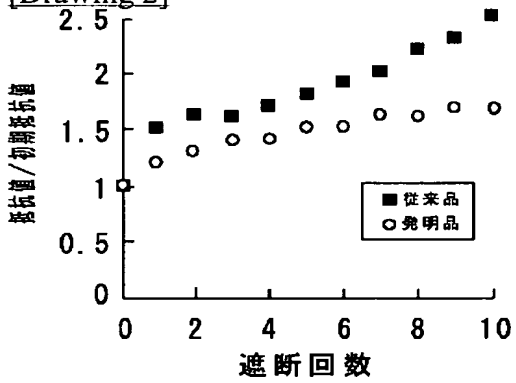
DRAWINGS

[Drawing 1]



[Drawing 2]



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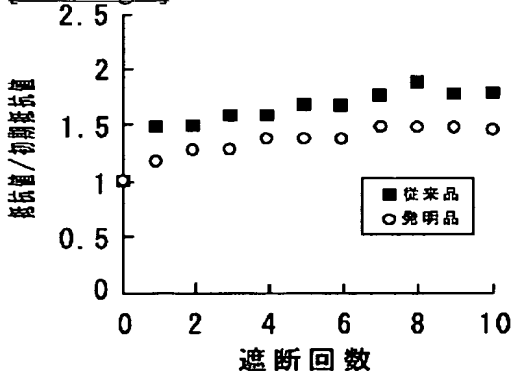

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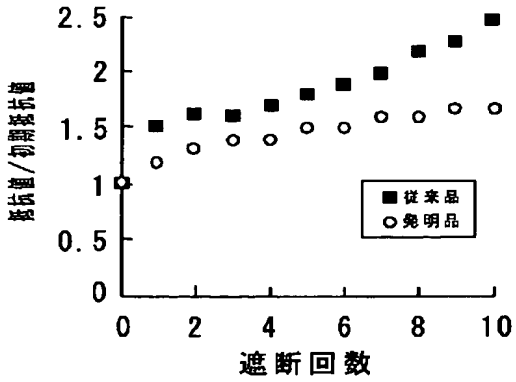

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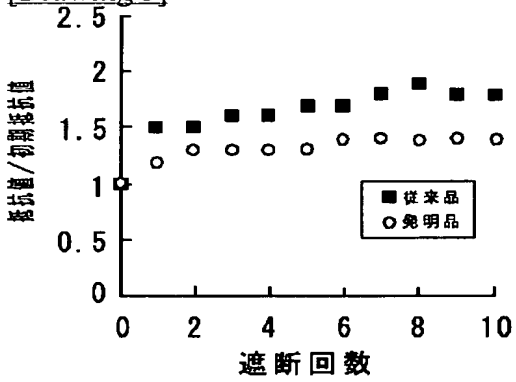

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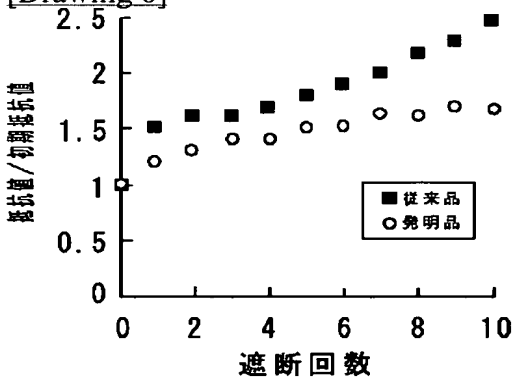
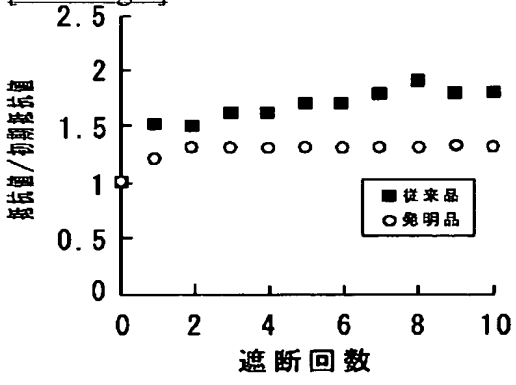
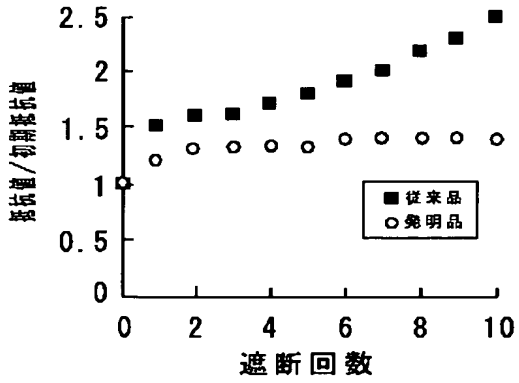


[Drawing 7]



[Drawing 8]



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